SD11
.A59R4
no.
84-29

FOREST PEST MANAGEMENT
Pacific Southwest Region

PSW FOREST AND RANGE
EXPERIMENT STATION
JUN 06 1985
STATION LIBRARY COPY

Report No. 84-29

3430 Evaluation
July 24, 1984

A BIOLOGICAL EVALUATION OF PINECREST CAMPGROUND AND PICNIC AREA, MEADOWVIEW CAMPGROUND, PIONEER GROUP CAMPGROUND, TRAIL OF THE SURVIVORS, AND SHADOW OF THE MIWOK TRAIL, SUMMIT RANGER DISTRICT, STANISLAUS NATIONAL FOREST

John Kliejunas, Plant Pathologist
John Dale, Entomologist

ABSTRACT

Two family campgrounds, one group campground, one picnic area, and two nature trails in the Pinecrest Area were evaluated for pest problems which may affect management objectives for the sites. The major pests noted were annosus root disease and white fir dwarf mistletoe. Management options -- including no change in current management direction, annosus root disease management, dwarf mistletoe management, hazardous tree reduction, vegetation management and integration of treatments -- are discussed.

INTRODUCTION

In response to a request from Blaine Cornell, Forest Supervisor, Stanislaus National Forest, we conducted a biological evaluation of several recreation sites in the Pinecrest Area during the week of May 21 - May 24, 1984. The sites included the Pinecrest Campground and Picnic Area, Meadowview Campground, Pioneer Trail Group Campground, Trail of the Survivors and the Shadow of the Miwok Trail. The summer home tracts in the area were not examined. We were accompanied during portions of the week by Ed Rosenbaum, Recreation and Lands Officer, Summit Ranger District, and on Wednesday morning by Pam Borman, Lead Technician, David Camp, Small Sales Assistant, Ron Ferrell, Sale Administrator, and Tom Phillips, Sale Preparation Forester, of the Summit District. A close-out meeting with Herb Hahn, District Ranger, Thomas E. Lewis, Stanislaus Forest Recreation Officer, and Ed Rosenbaum was held on Thursday morning.

USDA, FOREST SERVICE, PACIFIC SOUTHWEST REGION
State and Private Forestry, Forest Pest Management
630 Sansome Street, San Francisco, California 94111

The resource management objective for these sites is to maintain or improve the existing outdoor recreational experience by, in part, minimizing insect and disease activities that affect stand dynamics of recreation sites. The objectives of the evaluation were to identify existing and potential pest situations, to provide information on the expected future conditions of each site, and to present pest management alternatives for consideration by the Summit District during the development and implementation of a vegetation management plan for the area.

OBSERVATIONS

Pinecrest Campground

The 200 unit campground is located within an old-growth mixed conifer forest consisting of an overstory of ponderosa pine, white fir, incense-cedar, and sugar pine. Lodgepole pines are present in wet areas. Hardwoods, including a few oak and aspen, are a minor component of the vegetation. Understory vegetation is primarily white fir, incense-cedar and sugar pine. Shrubs are generally lacking, especially in Loop D where soil compaction is heavy from recreation use and passage to the shore of Pinecrest Lake. Some portions of the campground, such as between units D-5 and C-34, are overstocked with white fir reproduction. Screening between units, when present, is primarily white fir saplings and poles.

A "Mono" wind storm last winter resulted in the blow-down of numerous overstory trees in Loop A and in portions of Loop B. The larger-crowned trees were affected most. Much of the downed timber has been removed and the remaining slash is expected to be utilized as firewood by campers within a few weeks.

A diagramatic map of the campground with approximate locations of the insect and disease pests observed is in the Appendix (Fig. 1). Site-specific notes taken during the evaluation follow the map. Pests noted included annosus root disease (Fomes annosus) on white fir; Armillaria root rot (Armillariella mellea) on white fir; dwarf mistletoe (Arceuthobium abietinum f. sp. concoloris) on white fir; dwarf mistletoe (A. campylopodum) on ponderosa pine; true mistletoe (Phoradendron bolleanum ssp. pauciflorum) on white fir; true mistletoe (Phoradendron juniperinum ssp. libocedri) on incense-cedar; and western gall rust (Endocronartium harknessii) on lodgepole pine. Of these pests, annosus root disease, dwarf mistletoe on white fir, and dwarf mistletoe on ponderosa pine are affecting, or have the potential to affect, management objectives of the campground.

Annosus root disease was found fruiting in or on white fir stumps, but not pine stumps, in most portions of the campground except at Loop D. Signs of the fungus (fruiting bodies in decaying stumps) were more common in the wetter areas such as Loop A and Loop E. Apparently healthy sugar pine, incense-cedar, and ponderosa pine seedlings and saplings were in the vicinity of the infected white fir stumps. In

contrast, white fir reproduction adjacent to the infected stumps were occasionally dead. Many of the white fir stumps were colonized by A. mellea, as evidenced by rhizomorphs, dried up mushrooms, and the characteristic water-soaked, stringy, white pocket rot.

Annosus root disease was not found in the grassy opening between and in the upper portion of Loops B and C. Numerous "buckskin" ponderosa pine stumps, and some white fir and incense-cedar stumps, were present. Evidence of old western pine beetle (Dendroctonus brevicomis) attacks support the District's observation that pines in this area were killed by beetles during the drought years in the late 1970's. The residual cluster of large pines will become susceptible to the western pine beetle should conditions creating stress reoccur.

Western dwarf mistletoe was present on ponderosa pines at the mid- and upper-portions of Loop D, and in the vicinity of unit 15 in Loop E. In most instances, the dwarf mistletoe was confined to overmature overstory trees, with heavy brooming occurring above a clear bole in branches at 80 to 90 feet. Understory ponderosa pines were generally uninfected; they were uncommon adjacent to infected overstory trees, being replaced by or mixed with white fir, incense-cedar, and sugar pine.

One pocket of white fir dwarf mistletoe was noted near the upper end of Loop A. Bole cankers were fairly common on the pole-sized and the overstory white fir.

Two minor diseases were noted. Lodgepole pine saplings and poles near site 21 in Loop C had western gall rust cankers on branches and on main boles. True mistletoe was common on overstory white fir and on incense-cedar throughout the campground. True mistletoe was not observed in understory white fir.

Some lodgepole pines in Loop C apparently were killed by the emarginate ips (Ips emarginatus) while others were "strip attacked" -- the loss of a portion of the circumference for a varying vertical distance along the bole. The gallery patterns were not typical of the insect because the bark of the trees was exceedingly thin. As a result, the sapwood was very deeply etched. The mountain pine beetle (Dendroctonous ponderosae) was not present in the lower bole, but may have been present at mid-crown. Attacks by the red turpentine beetle (D. valens) were too few to have contributed greatly to mortality.

Pitch streaming on the upper boles of white firs was not evident within the campground. However, the flaking and cracking of patches of bark on the upper bole, and callus tissue on the lower bole, verified past activity of the fir engraver (Scolytus ventralis) in the stand. Limb mortality was rare.

The history of the stand indicates that heavily stocked areas of small white firs, such as the area between units D-5 and C-34, will eventually sustain attacks by S. ventralis, and perhaps other species of Scolytus. Some tree mortality can be expected, but the primary effect will be heavy patch attacks that reduce vigor.

Pinecrest Picnic Area

The Picnic Area, constructed about 1979, is adjacent to the lake and across the road from the eastern end of Pinecrest Campground. Vegetation is similar to that in the campground except that giant sequoias are planted near some parking areas. Heavy soil compaction and lack of understory cover are characteristic of the area. Dying white firs at the south end of the picnic area were noted at the time of construction. The dying has continued even though drains were constructed in an attempt to dry the soil. Sixteen standing dead white fir poles were present on the margins of an opening in the wet area near the southernmost restroom. Conks of F. annosus were present in white fir stumps in the opening.

Ponderosa pines at the north end of the Picnic Area began dying just after construction in 1979, and bark beetles in association with the drought were suspected as the cause. Numerous pines were blown down in this area last winter. Most stumps, roots, and debris have been cleared from the area. Fomes annosus was not found.

True mistletoe on overstory white fir was noted near the beach and was associated with dead tops on white fir north of the restroom at the amphitheater and at the north end of Picnic Area adjacent to the Pinecrest Resort.

Meadowview Campground

This 100 unit campground is within a mixed conifer forest similar to Pinecrest Campground, but with an open meadow and stream separating the lower units from the upper loop (units 202-219). Lodgepole pine and some aspen border the meadow. Ponderosa pines are more prevalent in the upper loop than in the lower two loops where white fir and sugar pine are more common. The area from sites 122 to about 135 is relatively wet compared to the remainder of the campground.

A diagramatic map of the campground with approximate locations of pests observed is in the Appendix (Fig. 2). As at Pinecrest, annosus root disease was associated with white fir stumps throughout the campground. Some stumps, across from unit 341 for example, had dead white fir saplings adjacent. The ponderosa pine, sugar pine, and incense-cedar saplings and poles in the vicinity of infected true fir stumps appeared vigorous and healthy. Unlike Pinecrest however, F. annosus conks were also found on ponderosa pine stumps -- on one stump at unit 317 and one stump across the road from unit 402. Two dead white fir saplings were adjacent to the infected pine stump at unit 402.

Dwarf mistletoe on overstory ponderosa pines was common throughout the upper loop and adjacent to the meadow, but was not observed in understory pines. Dwarf mistletoe on white firs was present at five centers in the lower two loops. Bole cankers on the white firs were common in

the vicinity of units 113 and units 311 to 313. Dwarf mistletoe (A. americanum) occurred on many of the lodgepole pines. True mistletoe on incense-cedar and true mistletoe on white fir occurred throughout the campground.

Pioneer Trail Group Campground

The approximately five acre group campground is also located in an old-growth mixed conifer forest a few miles east of Meadowview Campground. A map of the campground with locations of annosus root disease observed is in the Appendix (Fig. 3).

Fomes annosus was found associated with many of the white fir stumps, but not with pine stumps. The openings within group site 1 and adjacent to group site 2 are probably old annosus centers.

Western dwarf mistletoe on overstory ponderosa pine occurred throughout all three of the group areas, as did true mistletoe on white fir and on incense-cedar. One nonlethal blister rust (Cronartium ribicola) branch canker was found on a pole-sized sugar pine behind group site 2.

Trail of the Survivors and Shadow of the Miwok Trail

The 1/4 mile-long trails are in old-growth mixed conifer stands near Meadowview Campground (Fig. 2) and, in general, the same types of vegetation and associated pests were present.

At the Trail of the Survivors, annosus root disease was present in white fir stumps near stop 2 (60 degrees and 35 feet from sign), stop 4 (60 degrees and 80 feet from sign), stop 8, stop 9 (30 feet to right at bend in trail), and near the bench between stops 9 and 10. Dead pole-sized white fir were adjacent to these stumps. Galleries of the fir engraver were observed on dead white firs. Dwarf mistletoe in ponderosa pine and in white fir was common throughout.

Pests noted at the Shadow of the Miwok Trail (immediately adjacent to Meadowview Campground) included: F. annosus in white fir stumps near stops 10 and 11, dwarf mistletoe in overstory ponderosa pines across the trail from stop 2, and in the vicinity of stop 9; and Fomes pini on one Douglas-fir near stop 9.

MANAGEMENT ALTERNATIVES

The following management alternatives are generally applicable throughout the areas examined where a particular pest or group of pests was found. Biologies of pests are given in the Appendix.

1. No Change in Current Management Direction. Current levels of insect and disease activity will increase and contribute to site deterioration in the mature mixed conifer forest as soil compaction increases and other stress factors, including annosus root disease, true and dwarf

mistletoe, overstocking, and drought occur. Annosus root disease centers will continue to expand as long as there are root contacts with surrounding live true firs. The loss of true fir reproduction in these centers will decrease the amount of screening now present between some of the units. Trees with substantial root and butt rot will have a high probability of failure, especially during severe winter storms. Centers additional to those identified may be present because of the difficulty of detecting F. annosus in live true firs. When hazardous trees are removed or when blow-down occurs, new annosus centers may be created by infection of freshly-cut stumps and wounds from spores of the fungus.

Dwarf mistletoe in true fir may increase as the proportion of true fir in the stands increase due to loss of other tree species from stress factors and bark beetle attack. Dwarf mistletoe will infect understory white fir from the overstory source of infection to perpetuate the disease. Decay will develop in dwarf mistletoe bole cankers and create potentially hazardous trees. White fir in dense aggregations or white fir infected with annosus root disease may become severely infected with dwarf mistletoe because of slow growth. The long-term effect of dwarf mistletoe in ponderosa pine is the decadence and reduction of the host species as a major stand component. Although presently at low levels, pine bark beetles and the fir engraver may contribute to an increase in mortality, particularly in trees weakened by root disease, dwarf mistletoe, or other factors.

2. Annosus Root Disease Management. The most effective control for annosus root disease is prevention. The probability of the formation of new centers, and the resulting adverse effects of the disease discussed in Alternative 1, can be reduced by the application of borax (sodium tetraborate decahydrate, EPA Reg. No. 1624-94) to all freshly-cut conifer stumps in the Pinecrest Recreation Area (see FSM 3205, 2331.33 R-5 Supplement No. 90). Vegetation in and around annosus centers in white fir are naturally converting to pine and incense-cedar that are resistant to the strain of F. annosus on true fir. Thinning active centers may increase the tolerance of white fir to infection through increasing their rate of root regeneration and replacement. Thinning may have the same effect in the two centers associated with ponderosa pine stumps in Meadowview Campground.

3. Dwarf Mistletoe Management. Dwarf mistletoes can be controlled by eradication or by suppression. Eradication of dwarf mistletoe, which would involve removing infected hosts, is not viable or necessary in most of the areas examined. The mix of non-susceptible species is reducing dwarf mistletoe spread and impact by breaking up canopy-continuity. Because of this barrier, western dwarf mistletoe is having little if any impact on understory ponderosa pine even though a source of infection is present in infected overstory pines. One exception may be in the upper portion of Loop D in Pinecrest Campground, where western dwarf mistletoe is present in the understory. The same mix of non-susceptible species is also limiting the impact of dwarf mistletoe in the white fir.

Suppression of dwarf mistletoe involves minimizing the effects of the disease while tolerating a low level of infection. Various tactics are available for reducing the impact of dwarf mistletoe in recreation sites.

a. Broom pruning in ponderosa pine. The objective of removing witches' brooms is to prolong the life of the tree. Although witches' brooms are present on some overstory ponderosa pines, they are located above a clear bole in branches at 70 to 100 feet, and pruning would be difficult. An exception is some of the pines in the upper loop of Meadowview Campground where brooms are relatively close to ground level. Although removal of brooms might prolong the life of the trees, most of the trees have infected branches in the upper crown above the brooms, and broom pruning would not eradicate the parasite.

b. Remove infected overstory trees to protect regeneration. To prevent infection of understory trees, the infected overstory trees need to be removed to remove the source of inoculum. The understory should then be thinned and pruned to remove dwarf mistletoe infections.

c. Thinning. Thinning of infected stands will aid in maintaining optimum growth of residuals and reduce stress. Following release, lightly infected residuals may vertically outgrow the dwarf mistletoe. Infected trees growing at optimum stocking levels on good sites can achieve a rate of height growth greater than the rate of vertical spread of the dwarf mistletoe. Noninfected trees should be favored as leave trees. The removal of all trees with 6-class dwarf mistletoe ratings of 5 and 6 should be considered, because these trees have a high probability of dying in the next 10 to 15 years. White firs with bole infections should be considered for removal. Although bole infections are not serious from the standpoint of spreading dwarf mistletoe, they will deform the tree, lead to mortality in small trees, and may eventually result in open, decay-infected, bole cankers when the trees mature; a situation which is often hazardous in recreation areas. Treat all freshly cut stumps with borax to prevent invasion by F. annosus and treat green pine slash to prevent engraver beetle buildups.

In addition to minimizing the impact of dwarf mistletoe, thinning dense aggregations of conifers will minimize opportunities for root contact and subsequent spread of F. annosus. Increased tree vigor following thinning will also reduce the risk of attack of bark beetles.

d. Encourage tree species diversity. As mentioned, a mix of non-susceptible species in infected stands provides a barrier to spread of dwarf mistletoe. Maintaining the present species mix should be encouraged.

e. Create buffer strips. Attempts should be made to minimize the spread of dwarf mistletoe outward from the area of infestation. Susceptible species could be removed from the margins and the regeneration of non-susceptible species favored.

4. Hazardous Tree Reduction. The hazardous tree identification and removal program in the Pinecrest Area appears to be well-managed and effective. However, the application of borax to freshly-cut conifer stump surfaces could be better enforced, especially in the Pinecrest Campground which is under concession. Trees that are, or will become, potential hazards include those white firs with dead tops resulting from true mistletoe infection, and true fir with dwarf mistletoe bole infections.

In addition to hazardous tree removal, attempts to minimize formation of hazardous trees is necessary. This can include protecting residual trees during thinnings and education of public users to reduce their impact.

5. Vegetation Management. Although pest management techniques were described above for individual pests, they will not be completely effective in reducing tree mortality and maintaining recreational values if implemented without considering vegetation health as the goal, rather than as pest control. The objective of any pest management activity in the Pinecrest Area should be to promote the growth of mixed species stands that are healthy and vigorous, all-aged, and properly stocked. The present species diversity is minimizing the potential impact of pests in the recreation area. However, opportunities exist to maintain this diversity and to limit competition, thus reducing pest impact.

Native hardwoods (aspen, etc.) could be planted in some of the wetter sites, such as Loop A at Pinecrest Campground, and in the annosus center at the Picnic Area. The hardwoods may help dry out the areas, decrease the impact of annosus root disease by providing barriers to root spread, and may be less susceptible to blow-down. The use of shrubs -- including Ceanothus, dogwood, and other vegetation suited to the site -- for screening between units and for traffic management should also be considered. Concentration of foot traffic to specified trails, for example between the beach and Pinecrest Campground, would decrease soil compaction and reduce tree stress.

Thinning dense aggregations of white fir will have several beneficial effects. Opportunities for root contact and subsequent spread of F. annosus will be minimized. White firs that respond to release will likely outgrow any dwarf mistletoe infection and will be more tolerant to infection by F. annosus. Stumps created during thinning should be treated with borax to prevent colonization by F. annosus. In addition, thinning will alleviate overstocking as a predisposing factor to insect attack, and may enhance natural regeneration.

Slash within the campground does not present a potential engraver problem because the material soon disappears into campground fire places and pits. The creation of slash near recreation areas, but beyond the gathering propensity of the public, should be avoided between Thanksgiving and the 4th of July at Pinecrest.

6. Integrate Treatments. Management alternatives 2 through 5 are not mutually exclusive; they should be used alone or in combination in various parts of the Pinecrest Area to produce the results desired by the resource manager. Consideration of the interactions among all insect and disease problems present in the area during the development and implementation of a vegetation management plan will result in successful integration of pest management strategies, and best meet the stated objective.

APPENDIX

BIOLOGY OF PEST ORGANISMS

Following are summaries of the biology of diseases and insects causing mortality or damage in the areas evaluated.

Annosus Root Disease (Fomes annosus). Fomes annosus is a fungus that attacks a wide range of woody plants, causing a decay of the roots and lower bole and death of sapwood and cambium. All conifer species in California are susceptible to the fungus. Hardwood species are rarely damaged or killed. Infected pines are usually killed rather rapidly when the fungus girdles the root collar. In contrast, older true firs can survive infection for many years, although butt and root rot may become extensive, resulting in tree weakening and windthrow.

During periods favorable to the fungus, fruiting bodies form in decayed stumps, under the bark of dead trees, or in the duff at the root collar. The fungus becomes established in freshly cut stumps from air-borne spores produced by the conks, and then grows into the root system. True firs can also be infected by spores invading fresh basal wounds. The fungus then spreads to healthy roots of surrounding susceptible conifers via root contacts. In general, infections will cross from pine to true fir; however, rarely is the fungus observed to go from true fir to pine. Local spread of the fungus outward from a stump typically results in the formation of disease centers, with dead trees in the center and fading trees on the margin. These centers usually continue to enlarge until they reach barriers such as openings in the stand or groups of non-susceptible plants.

The fungus may remain alive for as long as 50 years as a saprophyte in infected roots and stumps. Young susceptible tree species often become infected and die after their roots contact old infected root systems in the soil.

Armillaria Root Disease (Armillariella mellea). This fungus is a parasite of a wide number of hosts, particularly oaks, but also other hardwoods and conifers. Generally, it colonizes dead and dying hardwood host tissue from which it may infect surrounding hardwoods and conifers, primarily those that are stressed.

Although the fungus produces honey-colored, gilled mushrooms in the fall that produce spores, these spores have not been shown to be effective disseminators of the fungus. However, A. mellea appears to be a common inhabitant of wood in forest stands. Once the fungus is established in woody tissue, it spreads underground between hosts by way of root contacts and rhizomorphs - black shoestring-like structures. These rhizomorphs may be on the outside of the root until the tree weakens, whereupon they can successfully invade the cambial region. Advance of the fungus in the tree then occurs primarily as mycelial fans, which are sheets of white fungal material of a rather tough and leathery consistency. When the fungus reaches the root collar, the tree dies.

Observations in California indicate that the fungus is generally not an active killer, except in close proximity to infected hardwoods. It is common to find it associated with other conifer root diseases, possibly accelerating the rate of tree mortality.

Dwarf Mistletoes. Western (Arceuthobium campylopodum); white fir (A. abietinum f.sp. concoloris); lodgepole pine (A. americanum): Western dwarf mistletoe infects Jeffrey, ponderosa and Coulter pines. White fir is the only host for white fir dwarf mistletoe, just as lodgepole pine dwarf mistletoe infects only lodgepole pine. Other conifers are rarely infected and hardwoods are immune to these pathogens. The pathogens are obligate parasites obtaining their nutrients, minerals and water from the host.

These parasites are dioecious, perennial higher plants that produce seeds as their means of spread. In the fall of the year when the fruit falls from the stem, the seed is ejected upward and outward. The seed adheres to any surface it contacts. When the seed lands in the crown of a susceptible host tree, it adheres to a needle or limb and overwinters. The following spring it germinates and penetrates the limb. For the next 2 to 4 years the plant grows in the tree limb, developing a root-like endophytic system in the inner bark and outer sapwood. It then produces aerial shoots and in another 2 to 4 years produces reproductive structures.

Spread of dwarf mistletoe is limited to the distance traveled by the seed, which from overstory to understory is usually 20 to 60 feet, but may be as much as 100 feet if wind assists the seeds. As a rule of thumb, dwarf mistletoe can spread horizontally to the understory a distance equal to the height of the infection in the overstory tree. Because of the various limits to spread, such as height of the source plant, angle of discharge, wind velocity, stand density, etc., the actual spread rate through an even-aged stand is about 1 to 2 feet per year.

True Mistletoes. White fir (Phoradendron bolleanum ssp. pauciflorum); incense-cedar (P. juniperinum spp. libocedri). These two true mistletoes are host-specific, with the white fir mistletoe infecting only white fir and the incense-cedar mistletoe infecting only incense-cedar. Like dwarf mistletoes, the true mistletoes are obligate parasites, but they are generally less demanding of their hosts because they manufacture many of their nutrients and usually require only water and minerals from their hosts.

True mistletoes are propagated and disseminated by seed. The seeds are spread by birds that feed on the berries. A viscous coating and hair-like threads on the outer surface of the seeds attach them firmly to twigs and branches, where they germinate and infect host tissues. Aerial plants develop from the specialized root-like systems (haustoria) several years after infection.

The incense-cedar mistletoe causes negligible damage to its host, but occasionally can build up to high populations and weaken older trees. White fir mistletoe can build up in and kill the tops of overstory white fir. These dead tops can become hazardous in campground situations.

Western Gall Rust (Endocronartium harknessii). Western gall rust causes branch galls and trunk cankers on nearly all species of hard pines. The rust fungus produces yellow to orange-colored spores (aeciospores) on the surface of the galls during cool, moist, spring weather. The spores are wind disseminated and can infect other pines directly. Invasion of the cambium through the pine bark by the rust fungus results in the formation of woody galls. Galls on branches are typically spindle-shaped. The galls continue to enlarge and produce new spores each spring until they have girdled and killed the branch or stem. Girdling of branches results in a reduction of tree growth. Trunk cankers deform and reduce the strength of the bole.

Fir Engraver (Scolytus ventralis). The fir engraver attacks most true firs in western North America. Attacks can result in mortality, top-kill, or patch kill along the bole in firs ranging from large saplings to old-growth. Mortality and top-kill frequently are associated with stress induced by overstocking, drought, root disease, soil compaction, excessive and sudden exposure, heavy dwarf mistletoe infections, and other factors limiting tree health and vigor. Because of the sporadic occurrence of widespread, severe mortality and top-kill and the prevalence of healthy broods in living trees (patch attacks), direct control measures are generally impractical. A healthy vigorously growing stand is the best means of minimizing damage from fir engravers.

Adults fly and attack trees or green fir slash between June and September; larvae, pupae, and adults overwinter under the bark of infested trees. The life cycle takes one year, rarely two. Pitch tubes are not formed as with pine bark beetles, but attacks often are characterized by boring dust in bark crevices along the trunk and pitch streamers on the mid- and upper-bole. Trees successfully attacked early in the summer may exhibit fading of the foliage by early fall, but those attacked later in the year will not begin to fade until the following spring or summer. The beetles may have emerged by the time the tree fades.

Several other species of Scolytus, along with Pseudohylesinus, may be associated with the fir engraver. These contribute to the damage, as does the roundheaded fir borer, Tetropium abietis, which is also a frequent associate.

The Emarginate Ips (Ips emarginatus). This pine engraver is capable of attacking any of the pines at Pinecrest. Usually it is associated with the mountain pine beetle in all but Jeffrey pine, where the associate is the Jeffrey pine beetle (D. jeffreyi). However, as apparently illustrated in Pinecrest lodgepole pines, it occasionally kills trees by itself.

The adults are large for engravers. Their egg galleries are usually straight and nearly parallel with the grain of the sapwood. However, these can become sinuous in thin-barked trees such as the declining lodgepole attacked at Pinecrest. If the similarity of the galleries to those of the mountain pine beetle is confusing, the engraver galleries can be distinguished by the presence of a nuptial chamber and the absence of boring dust packed in the egg galleries. The elevation and climate at Pinecrest indicate two generations per year, with the possibility of an additional partial generation.

Western Pine Beetle (Dendroctonus brevicomis). This insect is not currently active at Pinecrest. However, the number of ponderosa pine stumps with gallery patterns of this insect attest to its destructive potential. Normally this beetle breeds in overmature ponderosa pine, in windfalls, or in pines weakened by root-rots, drought, or stand stagnation. Under outbreak conditions it becomes aggressive and kills apparently vigorus ponderosa of all ages having bark sufficiently thick to protect the insect in its development. Pines under 6 inches dbh are seldom attacked, nor does the beetle breed in limbs.

Flight and attacks start late in spring or early summer and continue until stopped by cold weather. There are 2 1/2 to 4 generations in California, with much overlapping of generations.

Initial attacks on a standing tree are made about mid-bole and subsequent attacks fill in above and below. Inconspicuous pitch tubes and red boring dust are indications of success in overcoming tree resistance. Egg galleries cross and recross each other in a winding pattern. The larvae feed in the inner bark, working away from the egg gallery for about one-half inch and then turn into the outer bark, where they complete their development.

Mountain Pine Beetle (Dendroctonus ponderosae). At Pinecrest, adults could attack lodgepole, ponderosa or sugar pines from late June through August. They bore 2-4 ft. long vertical egg galleries in the phloem/cambium region from breast height to mid-crown, and lay eggs in niches along the sides of the gallery. A J-shaped hook is common at the lower 1-2 inches of the gallery. The larvae feed in mines perpendicular to the main gallery, and construct small pupal cells at the end of these mines, where they pupate and transform into adults.

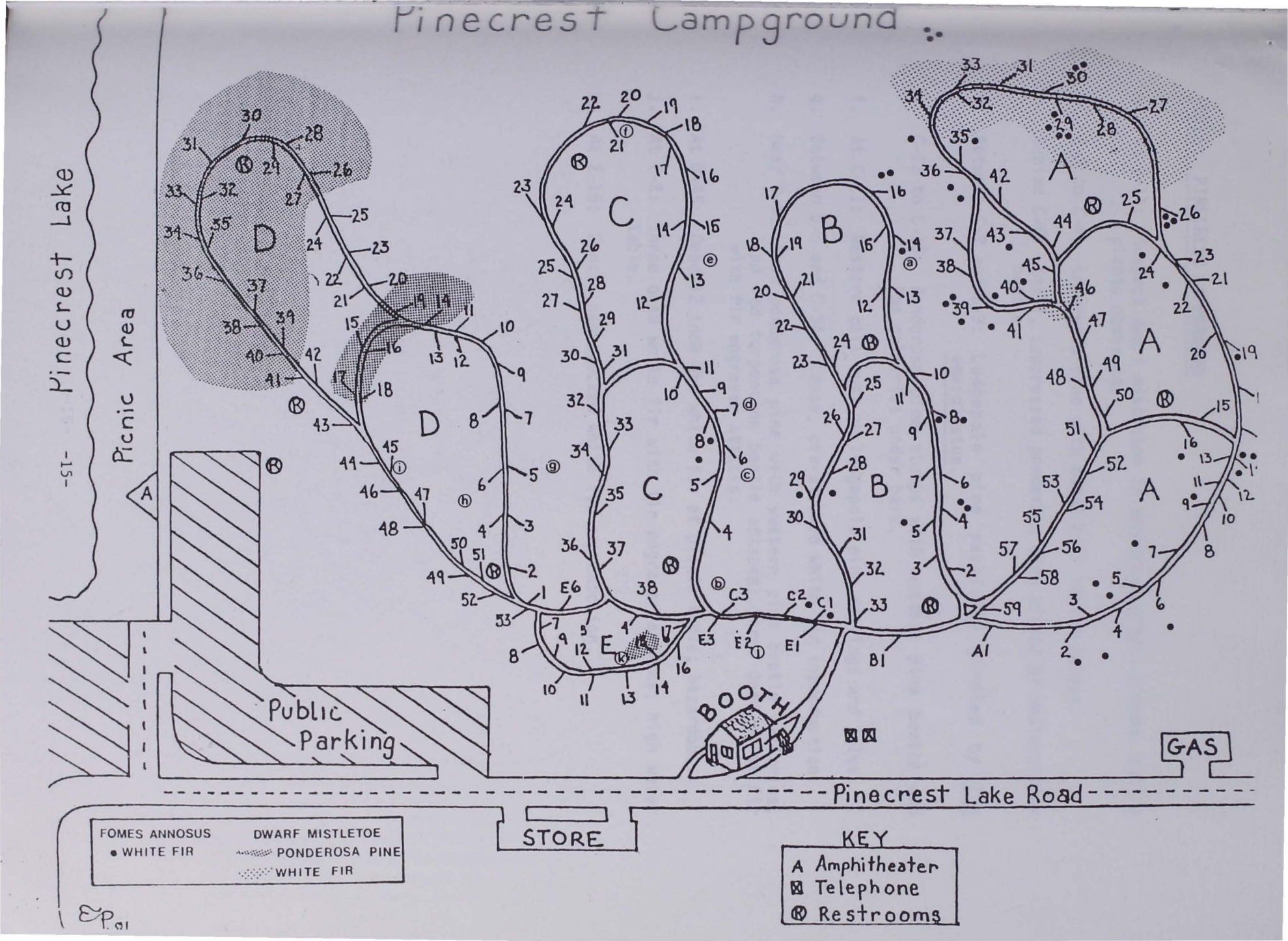
Damage is recognized by pitch tubes along the bole and red boring dust in bark crevices and on the ground. After successful attack, foliage becomes greenish yellow, then reddish brown, within a short period. The beetle is often active and devastating in densely-stocked stands of pole-size trees.

Red Turpentine Beetle (Dendroctonus valens). The pitch masses occurring in response to the boring of this beetle are often seen at the base of two- and three-needle pines in campgrounds. This is related to the basal wounds, soil compaction, and other factors stressing pines so frequently in campgrounds.

Ordinarily this beetle is not aggressive, but its attacks may synergize attacks by other bark beetles with a fatal result. There are exceptions, such as some of the pine mortality immediately following the drought in the 1970's. In 1978, dying pines often were found to be attacked by only one bark beetle, D. valens.

The adult red turpentine beetle is the largest bark beetle found in California. Its color is distinctly reddish brown. Attacks are characterized by large reddish pitch tubes at the base of pines, or up to 10 ft during stressful periods such as droughts.

On burrowing beneath the bark, the beetles excavate short, irregular, longitudinal to cavelike galleries in the phloem/cambium region of the lowermost bole and root crown. Unlike other California members of the genus Dendroctonus, the eggs are laid in elongate groups packed in frass along the sides of the gallery. The larvae feed en masse, producing a cavity usually ranging from 0.1 to 1 sq. ft. Transformation to pupae and adults takes place in cells made of frass in the brood chamber or in short mines along its margin. Generations per year vary from one to two or three in California, dependent upon climate.


Pinecrest Campground
Pinecrest Lake
Picnic Area
Public Parking
BOOTH
GAS
STORE
Pinecrest Lake Road
FOMES ANNOSUS
WHITE FIR
DWARF MISTLETOE
PONDERSOSA PINE
WHITE FIR
KEY
A Amphitheater
Telephone
Restrooms

NOTES: PINECREST CAMPGROUND

a. At B-14: Suspect dwarf mistletoe in ponderosa pines; brooms, but no plants observed.

b. C-3 to C-4: Lodgepole pine with basal bark beetle attack.

c. Behind C-6: Small, suppressed ponderosa pine killed by western pine beetle.

d. Between C-7 and C-9: Lodgepole pine partially girdled by Ips emarginatus.

e. C-13 to C-15: Ponderosa pine stumps with western pine beetle and Ips galleries under bark.

f. At C-21: Western gall rust on lodgepole pine saplings and poles.

g. Between D-5 and C-34: Dense, overstocked white fir reproduction.

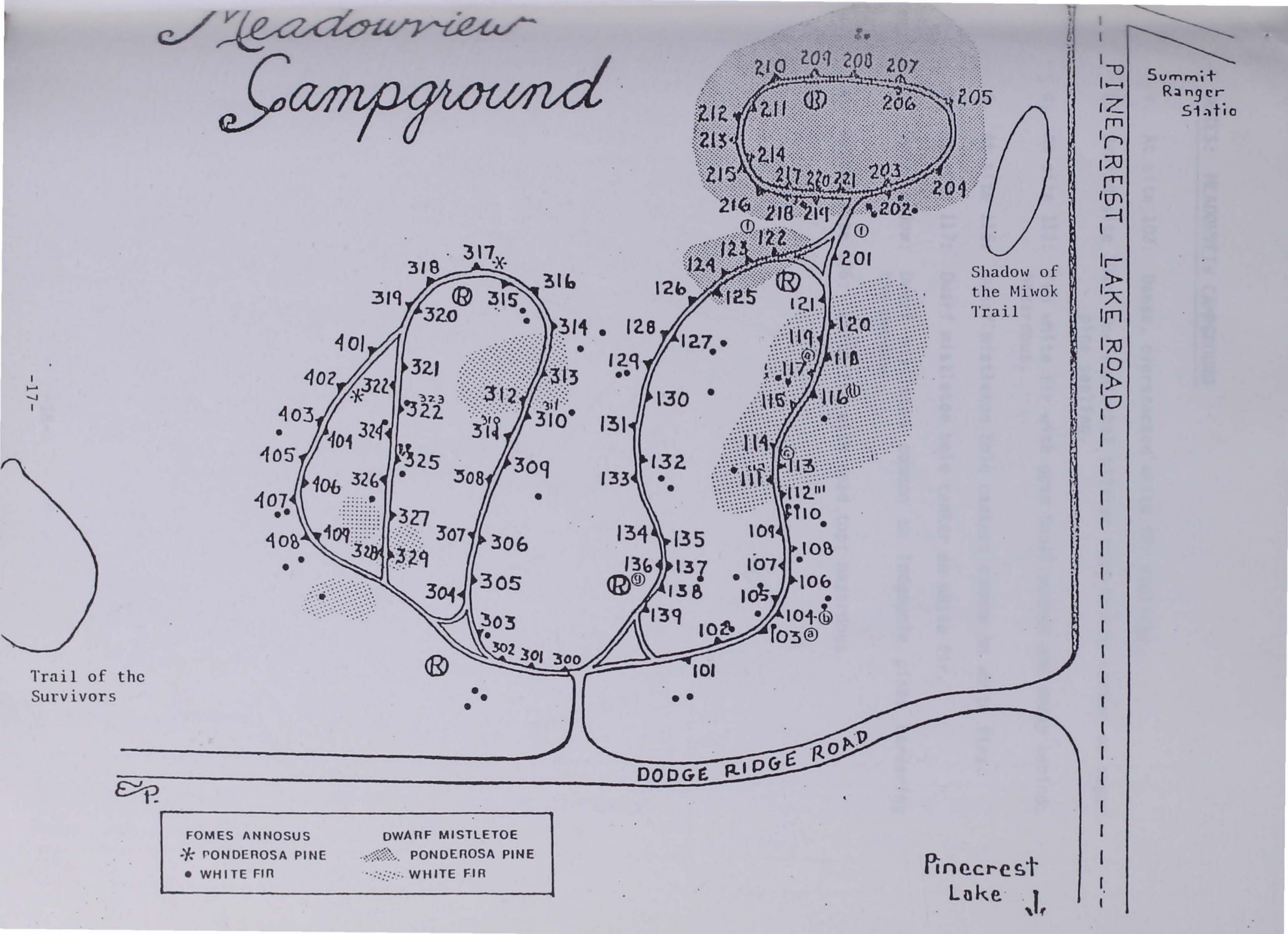
h. Near D-6: Dead ponderosa pine with western pine beetle galleries, and red turpentine beetle attacks; three dead white fir with fir engraver attacks.

i. At D-45: Dead 12 inch dbh white fir at picnic table; hazardous.

j. At E-2: Three dead white fir with fir engraver attacks; high water table.

k. At E-15: Dense, overstocked white fir reproduction.

Meadowview Campground



NOTES: MEADOWVEIW CAMPGROUND

a. At site 103: Dense, overstocked white fir saplings.

b. Behind site 104: One nonlethal blister rust branch canker on sugar pine sapling.

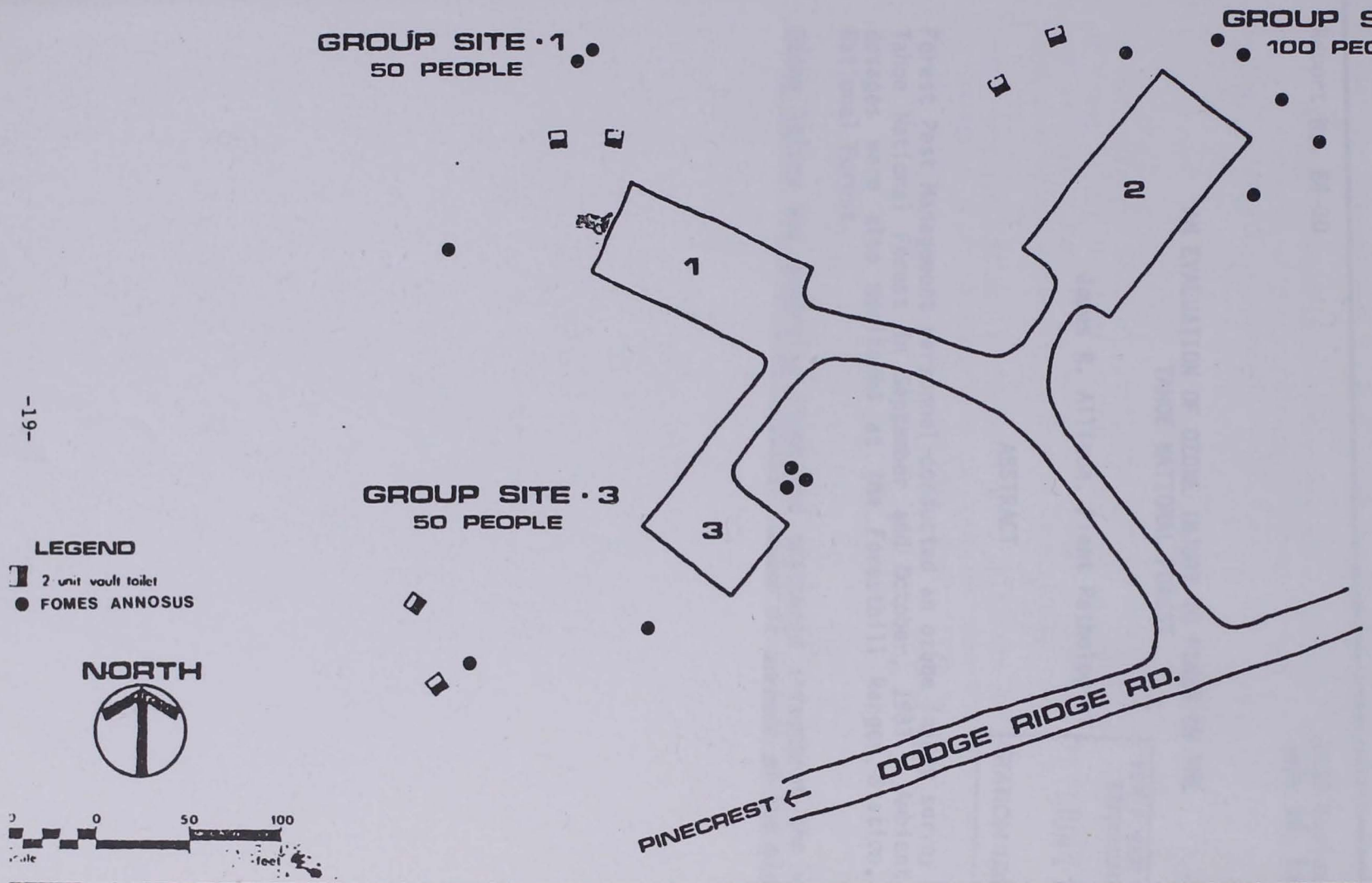
c. At site 113: Two white fir with open basal wounds and decay behind; hazardous.

d. At site 116: Dwarf mistletoe bole cankers common on white firs.

e. At site 117: Dwarf mistletoe bole canker on white fir.

f. Open meadow: Dwarf mistletoe common on lodgepole pines bordering the meadow.

g. Behind site 136: White fir with dead top; hazardous.



STANISLAUS National Forest
USDA · FOREST SERVICE · REGION 5

CAMPGROUND LAYOUT

PIONEER TRAIL
DISTRICT SUMMIT SEC 22, T 4 N, R 18 E, MD